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## ABSTRACT

The purpose of this study was to determine the effects of manual negative accentuated resistance on strength and/or muscular endurance. Three strength and/or muscular endurance tests were administered to male and female physical education majors enrolled in a required exercise class at the beginning and end of the semester. Push-ups, chin-ups, and dips were used because of the ease of administration. The class met three times a week for 13 weeks, and engaged in the prescribed exercise program which took about 15 minutes per class period. During that time, the students performed two sets each of three different exercises involving manual resistance. An average increase of 18.6 repetitions for push-ups was demonstrated among the men. Chins and dips for men had repetition increases of 3 and 5.4 respectively. The results for women were similar, although the base number of repetitions was different. Women showed increases of 12.9, 1.6, and 2.1 repetitions in push-ups, chins, and dips, respectively. These findings indicate that strength and/or muscular endurance can be increased significantly without the use of weight-training equipment. (PB) of 12.9, 1.6, and 2.1 repetitions in push-ups, chins, and dips respectively.

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EFFECTS OF MANUAL NEGATIVE ACCENTUATED RESISTANCE ON  
STRENGTH AND/OR MUSCULAR ENDURANCE

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ABSTRACT

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Objective

The purpose of this study was to determine the effect of manual negative accentuated resistance on strength and/or muscular endurance. In order to solve this problem, it was necessary to investigate the following sub problems.

1. Determine the strength and/or muscular endurance of subjects at the beginning of the semester.
2. Determine the strength and/or muscular endurance of subjects after one semester in the prescribed program.
3. Determine whether there was a change in strength and/or muscular endurance as indicated by the results of the pre and post tests.

Methods & Data Sources

Three strength and/or muscular endurance tests were administered during the first and last week of the semester. The traditional test items of push ups, chin ups and dips were used because of the ease of administration. Male and female physical education majors enrolled in a required exercise class constituted the research group. The mean age for this group was 20 years. A control group of physical education majors enrolled in an academic class was also investigated. Students were told that their performance in the pre test would be part of their grade. After the pre test results were obtained the students were informed that the post test scores as well as improvement would also be

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part of their grade. This was done to help motivate the student in each part of the experiment, and to help achieve maximum effort on both tests and during the work outs.

After allowing time for the pre and post tests, thirteen weeks remained in the semester. The class met three times a week and engaged in the prescribed exercise program which took about fifteen minutes per class period. During that fifteen minutes the students performed two sets each of three different exercises, making a work out total of six sets. Students were matched with a partner of similar size and weight and performed the exercises with aid of that partner. The three exercises paralleled the test items but instead of performing maximum number of repetitions, manual resistance was offered through the eccentric range so that eccentric fatigue occurred around ten repetitions. The positive or concentric portion of the exercise was performed by the student doing the exercise if possible, otherwise the partner would assist. Because eccentric strength is greater than concentric strength the above procedure worked out nicely. This fact also allowed training effects to take place when the concentric contraction was not strong enough to perform positive work. An example of this procedure is as follows.

A student doing a pushup would start from the prone position on the floor and push himself up to the top position with arms in full extension. From this position the student doing the exercise starts the negative phase or unlocks the elbows. Then his partner applies resistance by pushing on his upper back with enough force to make the eccentric movement last about five seconds. Tension is applied through

the full range of motion and the subject tries to resist the force by use of the eccentric contractions. This procedure is continued until the eccentric strength is not capable of resisting the manual force.

The other two exercises were done in a similar manner except that the manual resistance was applied by pulling instead of pushing on the body. All three exercises were demonstrated and explained thoroughly at the beginning and the instructor participated as each students partner at least once during the first two weeks of the experiment.

### Results

The results were encouraging. Push ups for men had an average increase of 18.6 repetitions over the 13 week period. Some students actually increased their pre test scores by 40 repetitions (from 60 to 100). Pushups showed the most increase, probably because the resistance was easier to apply. Chins and dips for men had repetition increases of 3 and 5.4 respectively.

The results for the women were similar, although the base number of repetitions was different. Women showed increases of 12.9, 1.6 and 2.1 repetitions in push ups, chins and dips respectively.

When these improvements were converted to percentages, the men showed an average gain of 3.23% of their pre test scores. The women produced an average repetition increase of 12.3% per week for the three exercises.

T-test comparisons with control group differences also showed significance at the .05 level.

### Conclusions

From these findings it is safe to conclude that strength and/or muscular endurance can be increased significantly with out the use of

weight training equipment. This conclusion should have meaning for coaches or physical education teachers who do not have strength training equipment or who's groups are too large to use existing equipment at the same time. Many other exercises also lend themselves to manual negative resistance. With a little ingenuity a coach could develop a total body strength and/or muscular endurance program that would cost nothing and still produce beneficial results.